

## THE TRANSFER OF INDUSTRIAL TECHNOLOGY TO THE UNDER-DEVELOPED COUNTRIES

by Charles Cooper\*

'Technology transfer' has quite suddenly become fashionable. It may be that after a long stagnation in the volume of official capital aid, there are pressures to find other ways in which the advanced countries can assist development - or even political pressures to show how much the advanced countries are actually doing - even if official credits have hardly grown at all. Developing countries generally want rapid industrialization - and practically by definition, this means they must get access to acquired technical knowledge and existing technology. So, from this point of view the transfer of technology is apparently a 'good thing'. It is a good thing also because far from being a burden on the advanced country balance of payments, technology transfers actually earn foreign exchange. The best of all possible worlds indeed.

Or is it? The univalent views of the advantages of the transfer of technology - as well as the innumerable proposals about how to 'stimulate' it - generally beg the very questions that should be asked in any serious diagnosis. This would not matter too much if it were not that even a preliminary look at what the 'transfer of technology' really is, and at the way it is carried out, raises serious doubts as to whether the right policy is to 'stimulate' transfer tout court. It is easy to agree that technology transfers - as they happen at present - are good for the foreign exchange reserves of the industrialized countries. The question is: are they good for development?

The transfer of technology covers the transfer from advanced to developing countries of the elements of technical know-how which are normally required in setting up and operating new production facilities and which are usually in very short supply (or totally absent) in the developing economies. The elements of know-how include such things as know-how for conducting feasibility and market studies, know-how for choosing technologies and for engineering design and plant construction - as well as the know-how which is embodied in the production process itself. This latter kind - which is called process know-how - is sometimes patented or at least kept secret by the companies which possess it. Process know-how probably gets most attention in the literature on transfer

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of technology. At the same time, however, the transfer of technology from advanced to under-developed countries involves far more than exchanges of patented process know-how. The technological dependence of the developing countries stems not only from their incapacity to invent new processes and products but also from lack of other, possibly more mundane skills and capacities, in areas like engineering design, choice of techniques, management and marketing.

On the face of it, enterprises in under-developed countries should be able to acquire the various kinds of technical know-how required in the construction and operation phases of a new project, through direct arrangements with consultants, individuals, plant construction companies, machinery producers and the like. Since these groups and individuals operate in more or less competitive markets, the recipient enterprise should benefit from the competitive prices they charge for their services.

In practice, however, it is probably rather seldom that the recipient enterprises arrange technology transfers in this way. Most transfer of technology - at least in the capitalist part of the world economy - involve an intermediary: an enterprise in the advanced countries, which so to say, supplies a part (usually a major part) of the technical knowledge which is required in a 'package'. The intermediary company is sometimes simply a contracting group. More often it is a company engaged in the kind of production activities which are to be transferred. It arranges the supply of know-how either from its own resources, or by sub-contracting consultants and machine suppliers etc., or by a mixture of both.

Most of the problems in technology transfer arise precisely because of the predominance of 'indirect' transfer mechanisms - involving intermediary companies. There are two questions about the indirect mechanisms which need to be explored. The first is why indirect mechanisms are used at all: in other words, what caused the recipient companies to use these methods of transfer? The second question concerns the incentives and motivations of the 'intermediary' companies: why do they get involved?

There are at least three factors which account for the importance of indirect mechanisms for technology transfer.

In the first place, the problem for enterprises in the under-developed countries is not simply to get the advice and technical knowledge they need in order to set up and operate new production facilities. It is also - and this may often be more important - to put the advice and the knowledge to use in an economically effective way. In order to do this the technology receiving

company must have, for example, the managerial and entrepreneurial ability to make decisions on the basis of feasibility and engineering studies. It must be able, also, to organise the various experts, consultant groups, machine suppliers and plant constructors that are involved in the construction phase - particularly in those cases where these suppliers of technical knowledge are independent of one another. In other words over and above the basic problem of getting a supply of technical knowledge, there is the problem of developing the capacity to use the knowledge once it is available. It is precisely these corporate skills which are very frequently lacking in enterprises in the under-developed economies. Because of these deficiencies recipient enterprises often have strong incentives to rely on the intermediary role of production companies in the advanced countries, which demonstrably possess these capabilities.

Second, this tendency appears to be re-inforced in those cases where the process technology which is transferred is in private ownership - for example, where it is patented. If, as is often the case, the process technology is highly differentiated the recipient company will have little choice and little incentive but to enter contractual agreement for the whole transfer process, with the process supplier. The supplier will sub-contract its machine-supplier and plant constructors to install the new production facilities.

Third, the tendency is also re-inforced where the recipient company is essentially seeking rights to the brand-names and trademarks of the supplier. Given that the supplier often has incentives to control the transfer, and sometimes subsequent production activities as well, he may well make wide-ranging contractual control over much of the transfer operation.

These three factors account for the fact that so many technology transfers are in fact carried out by various contractual agreements, involving production companies in the advanced countries. Direct investments to set up wholly-owned subsidiaries are one such form of transfer. Licensing agreements - sometimes involving equity participation and sometimes not - are another.

In competitive relationships, technological advantages are generally the source of quasi-monopoly power to the companies which have them. Unique possession of technology, for example, to manufacture a new or highly differentiated product, is the source of increased profits in imperfect markets, though this may of course be a transitory phenomenon rather like Schumpeter's 'entrepreneurial' profit. Looked at from this point of view, the 'intermediary' companies in technology transfer operations - in so far as they have differentiated process technologies to offer

(or other sources of differentiation such as brand-names) - are essentially seeking to reap the benefits of their competitive advantages in the markets of the under-developed country. They could, and often do, attempt to do this by exporting products. However, transferring production in various ways frequently is a more attractive proposition because the domestic markets of the under-developed countries are so often protected.

Protection appears to stimulate transfers of technology in three main ways.

First, when protective barriers are raised, foreign enterprises will have an incentive to transfer production into the under-developed country as a means of market-defence.

Second, once the transfer has taken place, the 'technological monopoly' of the supplying company may be reinforced by 'institutional monopoly' arising from the imperfection of industrial markets in under-developed countries.<sup>1</sup> These markets are too small to support many producers for any given commodity: whilst small markets are not advantageous per se, monopolistic control of a small market may be so.

Third, the barriers to entry in the under-developed country's market, may well keep out competition for long periods. The supplying company may be able to extend the period of quasi-monopoly conferred by technological advantages.

The institutional set-up in which technology transfer actually takes place, leads to a number of negative consequences. Most of these negative aspects arise because intermediary companies naturally use their technological monopolies to best advantage from their own point of view. These are, of course, constraints on what they can do, but by and large these do not seem to have been very effective. In consequence, many technology agreements have aspects which have anti-developmental consequences. Amongst the most important restrictive clauses in transfer agreements are:-

(i) clauses which limit sales of the new product to the domestic markets of the under-developed country itself. These clauses often reflect the strategic requirements of the multinational companies which predominate in many transfer operations. They are designed to prevent competition in third markets.

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<sup>1</sup> The work of Vaitsos is relevant in this respect. (See elsewhere in this issue, ed.)

(ii) clauses which tie the recipient company to the technology-supplier, for supplies of equipment and intermediate goods.

There are other problems beyond the explicit application of restrictions. One such problem is that the very conditions which stimulate transfers in the first place (i.e. protection of the domestic market in under-developed countries) also lead to high cost, uncompetitive production. Export restrictions in transfer agreements are often an unnecessary precaution, because the recipient enterprise is anyway uncompetitive in international markets. This must to some extent account for the fact that technology transfers have not had much impact on the export position of under-developed countries in manufactured goods.

The fact that supplying companies make transfers partly because there are highly imperfect markets to exploit in the under-developed country, has wider implications. In particular, it may be that technology transfer operations tend to perpetuate irrational and inefficient use of scarce investible resources.

And finally, there is the problem of choice and adaptation of technology, which currently receives a great deal of attention in discussions of the 'unemployment problem'. The mechanisms that are actually employed to transfer technology probably limit the possibilities of making a choice of technology in any given line of production. And given the control which the technology supplier exerts over the recipient, the possibilities of technological adaptations are probably rather small. The supplier company has to weigh the opportunity costs of using its scientists and technicians to produce adapted techniques, instead of using them in the hunt for innovations which will help to sustain competitive advantages in industrialised markets. The private calculations of supplier companies generally seem to work out against adaptation.

Our main pre-occupation has been to throw some doubts on simplistic approaches to a newly fashionable subject. Policies for technology transfer need to do a good deal more than simply 'stimulate' the kind of activity which is in process.

A number of the problems associated with transfer operations seem to arise because import-substitution policies are broad and indiscriminating, and transfer operations might well have more positive effects on export promotion if protection policies were more selective. In any case, there are serious doubts about the developmental value of many of the products manufactured by means of transferred technology. An effective policy on technological transfer really implies more clearly defined policies on consumption. These, however, appear to be hard to achieve, and an inexhaustible source of political difficulties.